Geotechnical Engineering Report

VAMC Visitor Parking South

1901 Veterans Memorial Drive

Temple, Texas

April 22, 2015

Terracon Project No. 96155050

Prepared for:

H2B, Inc.
Houston, Texas

Prepared by:

Terracon Consultants, Inc.
Austin, Texas

April 22, 2015

H2B, Inc.
1225 North Loop West, Suite 900
Houston, Texas 77008

Attn: Mr. Lane Lackey
Phone: (713) 864 2900
Email: lane.lackey@h2bengineers.com

Re: Geotechnical Engineering Report
VAMC Visitor Parking South
1901 Veterans Memorial Drive
Temple, Texas
Terracon Project No. 96155050

Dear Mr. Lackey:

Terracon Consultants, Inc. (Terracon) is pleased to submit our Geotechnical Engineering Report for the proposed VAMC Visitor Parking South project in Temple, Texas. We trust that this report is responsive to your project needs. Please contact us if you have any questions or if we can be of further assistance.

We appreciate the opportunity to work with you on this project and look forward to providing additional Geotechnical Engineering and Construction Materials Testing services in the future.

Sincerely,
Terracon Consultants, Inc.
(TBPE Firm Registration: TX F3272)

STATE OF TEXAS
4/22/15
JENSEN JOHN VICTOR SELVAKUMAR
110004
LICENSED
PROFESSIONAL ENGINEER

Jensen P. John, P.E.
Project Manager

for Bryan S. Moulin, P.E.
Principal, Geotechnical Department Manager

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GEOTECHNICAL ENGINEERING REPORT

VAMC VISITOR PARKING SOUTH
1901 Veterans Memorial Drive
Temple, Texas

Terracon Project No. 96155050
April 22, 2015

1.0 INTRODUCTION

Terracon is pleased to submit our Geotechnical Engineering Report for the proposed VAMC Visitor Parking South project in Temple, Texas. This project was authorized by Mr. Lane Lackey with H2B, Inc. through signature of our Agreement for Services on March 10, 2015. The project scope was performed in general accordance with Terracon Proposal No. P961500308 dated March 9, 2015.

Terracon performed four (4) of the 5 borings planned across the site for this geotechnical exploration. The boring numbered B-4 was not performed due to drill rig access constraints.

The purpose of this report is to describe the subsurface conditions observed at the 4 borings performed for this exploration, present the results of the field and laboratory testing, analyze and evaluate the test data, and provide recommendations relative to:

- Pavement design and construction; and
- Site earthwork, subgrade preparation, and fill placement.

2.0 PROJECT INFORMATION

2.1 Site Location and Description

Item	Description
Location	This project site is located at 1901 Veterans Memorial Drive in Temple, Texas. It is located within the Central Texas VA Health Care facility. (See Exhibit A-1 of Appendix A).
Existing Conditions	Most portions of the project area were previously occupied by a building, which has been demolished and removed. The southern portion of the project site is a helicopter pad.
Current Ground Cover	Mostly grass in the area surrounding the helicopter pad and existing

Item	Description
	landscape zones.
Existing Topography	Information not available at the time of this report.

2.2 Project Description

Item	Description
Site Layout	See Exhibit A-2, Boring Location Plan, in Appendix A.
Proposed Improvements	The project will include partial demolition of the existing parking lot, helicopter pad and construction of a new asphalt paved parking lot.
Site Grading	Information not available at the time of this report, but assumed to be ≤ 2 feet from existing grades.
Cut and Fill Slopes	Assumed to be no steeper than 3H:1V (Horizontal to Vertical), if any.
Free-Standing Retaining Walls	None.

If any of the above information or assumptions be inconsistent with the planned construction, please let us know so that we may make any necessary modifications to this report.

3.0 SUBSURFACE CONDITIONS

3.1 Typical Profile

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs in Exhibits A-4 through A-7 of Appendix A.

Surface materials consisting of approximately 1-inch asphaltic concrete over about 4 inches of granular base material was encountered at the surface of boring B-2 and approximately 9 inches of granular base material was encountered at the surface of boring B-5.

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows.

Description	Approximate Depth Range of Stratum (feet)	Material Encountered	Consistency/ Density
Stratum I [1]	0 to 4	Fills: Dark brown to brown to gray brown fat clays (CH), lean clays (CL) and poorly graded sands (SP)	Stiff to very stiff/ Medium dense

Description	Approximate Depth Range of Stratum (feet)	Material Encountered	Consistency/ Density
Stratum IIA [2]	2 to 5.5	Dark brown fat clays CH)	Stiff to very stiff
Stratum IIB [3]	2 to 7	Tan to light brown lean clays (CL) and clayey sands (SC)	Stiff to hard/ Dense to very dense
Stratum III [4]	3 to 10 (termination depth of the borings)	Light brown to tan marl/weathered limestone	-

1 The Stratum I fills consisted of dark brown to brown fat clays in borings B-1, B-2 and B-3 and, sands and lean clays in boring B-5. These soils were encountered at the surface of the borings or beneath the surface materials and extended to depths ranging between 2 and 4 feet. The clayey fill soils exhibited moderate to high shrink/swell potential as indicated by measured plasticity index values (PI) in the range of 24 to 51 (average PI of about 37) in the tested samples. In-situ moisture content of tested samples ranged between the plastic limit and 3 percent wet of the corresponding plastic limit. Percent fines (percentage of soil sample material passing No. 200 sieve comprising clay and silt fractions) in the tested clay samples ranged from about 83 to 90 percent. Standard penetration test (SPT) resistance values (N-values) in this stratum ranged from 10 to 21 blows per foot of penetration (bpf). Pocket penetrometer value of 2.5 tons per square foot (tsf) was recorded for a sample in this stratum.

2 The Stratum IIA dark brown fat clay soils were encountered below the Stratum I fills in borings B-1 and B-3 and extended to depths in the range of about 4 to 5½ feet. These native fat clays were not encountered in borings B-2 and B-5. These soils exhibited very high shrink/swell potential as indicated by measured PI's of 52 and 59 along with percent fines of 94 percent in the tested samples. In-situ moisture content was at plastic limit and 16 percent wet of the corresponding plastic limit in the two tested samples. SPT resistance value of 15 bpf was recorded for a sample in this stratum. Pocket penetrometer values of 1 and 4.5 tsf were recorded in this stratum.

3 The Stratum IIB tan to light brown lean clays and clayey sands were encountered below the Stratum IIA fat clays in boring B-1 and below the Stratum I fills in borings B-2 and B-5. These soils were not encountered in boring B-3. These soils exhibited low to moderate shrink/swell potential as indicated by measured plasticity index values of 16 and 30 along with percent fines of 81 and 85 percent in the tested samples. In-situ moisture content of the tested samples were 2 to 8 percent dry of the corresponding plastic limit. SPT resistance values ranged from 56 bpf to 50 blows per 5 inches of penetration. The relatively high SPT resistance values were likely due to sampling near the interface with the underlying Stratum III marl/weathered limestone.

4 The Stratum III light brown to tan marl/weathered limestone material were encountered below the Stratum IIA/IIB soils at depths ranging between 3 and 7 feet and extended to the termination depth of the borings. SPT resistance value in this stratum ranged from about 50 blows per 6 inches of penetration to 50 blows per 2 inches of penetration. A clay seam encountered within

Description	Approximate Depth Range of Stratum (feet)	Material Encountered	Consistency/ Density
this stratum in boring B-1indicated a high PI of 31 along with percent fines of 93 percent.			

3.2 Groundwater

The borings were dry augered to depths of about 10 feet below existing grades. Water seepage was not encountered in the borings during drilling operations.

Although not encountered during our field program, groundwater at the site may be observed in the form of seepage traveling along pervious seams/fissures in the soil and along the soil/limestone interface. During periods of wet weather, zones of seepage may appear and isolated zones of "perched water" may become trapped (or confined) by zones possessing a low permeability such as the clay soils encountered on site. Groundwater conditions at the site could fluctuate as a result of seasonal and climatic variations. Please note that it often takes several hours/days for water to accumulate in a borehole, and geotechnical borings are relatively fast, short-term boreholes that are backfilled the same day. Long-term groundwater readings can more accurately be achieved using monitoring wells. Please contact us if this is desired. Groundwater conditions should be evaluated immediately prior to construction.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

The following recommendations are based upon the data obtained in our field and laboratory programs, project information provided to us, and on our experience with similar subsurface and site conditions. Throughout this report, references to TxDOT specifications are intended to imply the most current version, released November 1, 2014.

4.1 Earthwork

Construction areas should be stripped of vegetation, topsoil, existing pavement layers and other unsuitable material such as wet/loose/soft soils. The existing pavement layers (asphaltic concrete and base material) should be stockpiled separate from soils and other materials, if it is planned for re-use as fill material in pavement areas. We recommend that Terracon be retained to assist in evaluating exposed subgrades during earthwork so that unsuitable materials, if any, are removed at the time of construction.

After stripping or cutting to design grade in areas above design grade or prior to fill placement in areas below design grade, the exposed subgrade should be carefully proofrolled with a 20-ton pneumatic roller or a fully loaded dump truck to detect weak zones in the subgrade. Weak areas detected during proofrolling, as well as zones containing debris or organics should be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils.

Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and causes construction delays and/or inhibit site access.

Subsequent to proofrolling, and just prior to placement of fill, the exposed subgrade within the construction areas should be evaluated for moisture and density. If the moisture and/or density requirements do not meet the criteria described in the table below, the subgrade should be scarified to a minimum depth of 6 inches; moisture adjusted and compacted to at least 95 percent of the TEX-114-E maximum dry density (or TEX-113-E as appropriate). Moisture conditioning is not required in areas where Stratum III marl/limestone is exposed.

4.1.1 Fill Compaction Requirements

All fill material should be placed in uniform lifts not to exceed 8 inches loose measure, with compacted thickness not to exceed 6 inches, unless stated otherwise. Fill should be compacted to at least 95 percent of the maximum dry density determined by TEX-113-E or TEX-114-E (depending upon soil type).

Imported fill to be used for grade adjustments in pavement or general areas or proposed embankments should meet the requirements of Type B borrow material as outlined in TXDOT Item 132; however, the PI values of the imported fill should not exceed 30. Excavated Stratum IIB soils consisting of lean clay (CL) and clayey sand (SC) soils, lower plasticity soils (PI < 30) of Stratum I fills as well as Type B borrow material should be compacted at a moisture content ranging between -3 and +3 percent of optimum moisture content.

The fat clay portions of Stratum I fills and Stratum IIA fat clay soils should be moisture conditioned between optimum and +4 percent of optimum moisture content.

4.1.2 Use of On-Site Material for Fill in Pavement Areas

Excavated on-site soils and Stratum III marl/limestone, if free of organics, debris, and rocks larger than 4 inches, may be considered for use as fill in pavement or other general areas. As stated in **Section 4.1 – Earthwork**, the existing pavement layer materials (asphalt and base) should be carefully excavated and stockpiled separate from soils and other materials, if it is planned for re-use as on-site fill in pavement areas.

4.1.3 Drainage

The performance of the proposed pavements will not only be dependent upon the quality of construction, but also upon the stability of the moisture content of the near-surface subgrade. Therefore, proper site drainage should be developed during and after construction so that ponding of surface water on the pavement surfaces and along the pavement perimeters does not occur. If proper surface drainage cannot be accomplished on and within 5 feet of the pavement edges, we suggest that drainage swales be constructed alongside the pavements. The drainage swales should be sloped to collect and remove water away from the pavement systems.

Poor drainage conditions could result in saturation of base material and/or the underlying subgrade, which in turn could induce pavement distress and affect pavement performance. If development of proper drainage is not possible, curbs should extend through the base and into the subgrade.

4.2 Excavation

Excavation operations at the site such as utilities may penetrate into the Stratum III marl/ limestone. Excavation of this stratum with conventional excavation equipment may be difficult. Our past experience with limestone in this region indicates that zones of resistant limestone which could require sawcutting, jack hammering, hoe-ramming, milling, or similar techniques to excavate should be expected although more highly weathered zones of limestone should be rippable with proper heavy equipment. Therefore, appropriate equipment (such as rock trenching equipment and/or hoe rams) may be required by the Contractor during excavation.

Our comments on excavation are based on our experience with the rock formation. Rock excavation depends on not only the rock hardness, weathering, and fracture frequency, but also the contractor's equipment, capabilities, and experience. Therefore, it should be the contractor's responsibility to determine the most effective methods for excavation. The above comments are intended for informational purposes for the design team only and may be used for planning purposes.

4.3 Pavements

Detailed traffic loads and frequencies were not available for the pavements. However, we anticipate that traffic will consist primarily of passenger vehicles in the parking areas (assumed as the light duty pavements) and passenger vehicles combined with occasional garbage and delivery trucks in driveways. If heavier traffic loading is expected or other traffic information is available, Terracon should be provided with the information and allowed to review the pavement sections provided herein. Tabulated below is the assumed traffic frequency and load used to design the pavement section for this project.

PAVEMENT TYPE	TRAFFIC DESIGN INDEX	DESCRIPTION
Parking Areas (Passenger Vehicles Only – Light Duty)	DI-1	Light traffic – Few vehicles heavier than passenger cars, panel, and pick-up trucks; no regular use by heavily loaded two-axle trucks or

PAVEMENT TYPE	TRAFFIC DESIGN INDEX	DESCRIPTION
		lightly loaded larger vehicles. (EAL* < 5)
Driveways (Light-Medium Duty)	DI-2	Medium to light traffic – Similar to DI-1, including not over 50 heavily loaded two-axle trucks or lightly loaded larger vehicles per day. No regular use by heavily loaded trucks with three or more axles. (EAL = 6 – 20)

* Equivalent daily 18-kip single axle load applications.

4.3.1 Pavement Design Subgrades

We anticipate that the Stratum I fat clay soils will generally act as the pavement subgrade in areas that are at-grade or that will receive minimal cuts. In fills areas, we anticipate Type B borrow material (PI≤35) or on-site soils excavated from other areas. We have also assumed that the pavement subgrade is prepared as outlined in the "Moisture Conditioned Subgrade" portion of this section and is proofrolled in accordance with our general recommendations for site preparation in **Section 4.1 – Earthwork**. We should note that these systems were derived based on general characterization of the subgrade. No specific testing (such as CBR, resilient modulus tests, etc.) was performed for this project to evaluate the support characteristics of the subgrade. The final subgrade should be verified by the General Contractor and Terracon representatives during construction.

4.3.2 Pavement Section Thicknesses

Pavement component thicknesses for the proposed parking lot are presented in the following table.

Flexible Pavement System

Pavement Component		Material Thickness (inches)	
		DI-1	DI-2
Asphaltic Concrete (HMAC)	Type C/D	2.0	2.5
Crushed Limestone Base (CLB)		8.0	10.0
Moisture Conditioned Subgrade (MCS)		12.0*	12.0*
Total Thickness (including MCS)		**22.0**	**24.5**

*In subgrade areas consisting of Stratum IIA and fat clay portions of Stratum I, moisture conditioning and recompaction should be performed to a depth of at least 12 inches. In Stratum IIB or imported fill subgrades, moisture conditioning can be limited to the upper 6 inches.

Presented below are our recommended material requirements for the various pavement components tabulated above. Material specification references below include both TxDOT Standard Specifications and City of Temple (CoT) Technical Specifications, where available.

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Hot Mix Asphaltic Concrete (HMAC) – We recommend that the asphaltic concrete should meet the Item 302 Asphalt Materials and Pavement of the CoT Design and Development Standards Manual or per accordance with master specification requirements described in TxDOT, Item 340.

The mixes should be designed for stability and compacted within the lift thicknesses and density ranges as outlined in Item 302 Asphalt Pavement of the CoT Design and Development Standards Manual. The asphalt acceptance and payment criteria outlined in TxDOT Item 341 may be considered for use by the Client.

Crushed Limestone Base (CLB) – Base material should be composed of crushed limestone meeting the requirements of TxDOT Item 247, Type A, Grade 1-2 and/or Item 301 of CoT Design and Development Standards Manual. The base should be compacted to a minimum of 100 percent of the maximum dry density as determined by TEX-113-E at -3 to +3 percent of optimum moisture content. Each lift of CLB should be thoroughly proofrolled just prior to placement of subsequent lifts and/or asphalt. Particular attention should be paid to areas along curbs and adjacent to landscape areas, manholes, box culverts and storm drain inlets. Placement and compaction of CLB should extend at least 18 inches behind curbs.

Moisture Conditioned Subgrade (MCS) – The soil subgrade should be scarified to a depth of 6 to 12 inches (as stated in the table above in **Section 4.3.2**), moisture conditioned, and recompacted to at least 95 percent of the maximum dry density as determined by TEX-114-E. The fat clays of Stratum I fills and Stratum IIA fat clay soils that remain in place after the recommended stripping should be moisture conditioned (at least 12 inches below the bottom of the base material) to between optimum (0) and +4 percent of optimum moisture content. Imported Type B borrow fills, lower plasticity (PI < 30) soils of Stratum I fills and Stratum IIB soils should be moisture conditioned to between -3 and +3 percent of optimum moisture content.

Care should be taken such that the subgrade does not dry out or become saturated prior to pavement construction. Moisture conditioning is not necessary in intact marl/limestone subgrade areas. The pavement subgrade should be thoroughly proofrolled with a rubber-tired vehicle (fully loaded water or dump truck) immediately prior to placement of base material. Particular attention should be paid to areas along curbs, above utility trenches and adjacent to landscape areas and storm drain inlets. Placement and compaction of MCS should extend at least 18 inches behind curbs.

Pavement design methods are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support. However, support characteristics of the subgrade can be greatly affected by moisture and shrink/swell movements of clay subgrade. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. It is, therefore, important to control moisture changes in the subgrade to reduce shrink/swell movements. Proper perimeter drainage should be provided so that infiltration of surface water from unpaved areas surrounding the pavement is minimized. We should note that post-construction subgrade movements and some cracking of asphaltic pavements is common for conditions such as those observed at this site.

On most projects, rough site grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas; dry weather may desiccate some areas; rainfall and surface water saturates some areas; heavy traffic from concrete and other delivery vehicles disturbs the subgrade; and many surface irregularities are filled in with loose soils to temporarily improve subgrade conditions. As a result, the pavement subgrade should be carefully evaluated as the time for pavement construction approaches. This is particularly important in and around utility trench cuts, manholes, and storm drain inlets, as well as any landscaped and irrigated areas. All pavement areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to paving. Thorough proofrolling of pavement areas using a fully-loaded water truck or dump truck (rubber-wheeled vehicle that can impart point wheel loads) should be performed no more than 24 hours prior to surface paving. Any problematic areas should be reworked and compacted at that time. Proofrolling should be re-performed if the subgrade and/or base are exposed to rainfall prior to subsequent construction activities, after replacement of the wet materials or reworking of the wet materials.

Long-term pavement performance will be dependent upon several factors, including maintaining subgrade moisture levels and providing for preventive maintenance. The following recommendations should be considered at a minimum:

- Adjacent site grading at a minimum 2% grade away from the pavements;
- A minimum ¼ inch per foot slope on the pavement surface to promote proper surface drainage;
- Install joint sealant and seal cracks immediately; and
- Placing compacted, low permeability clay backfill against the exterior of curb and gutter.

Preventive maintenance should be planned and provided for through an on-going pavement management program. These activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Preventive maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (overlays). This is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements. Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventive maintenance.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide testing and observation during earthwork operations, pavement installation and other construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include, either specifically or by implication, any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

For any excavation construction activities at this site, all Occupational Safety and Health Administration (OSHA) guidelines and directives should be followed by the Contractor during construction to provide a safe working environment. In regards to worker safety, OSHA Safety and Health Standards require the protection of workers from excavation instability in trench situations.

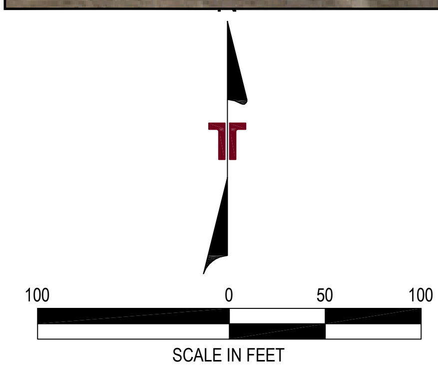
This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

FIELD EXPLORATION

SCALE 1:100

Project Mngr: JPJ	Project No. 96155050	Terracon Consulting Engineers and Scientists	SITE LOCATION DIAGRAM	EXHIBIT
Austin CAD	Scale: AS SHOWN	5307 INDUSTRIAL OAKS BLVD - #160 AUSTIN, TEXAS 78735	VAMC Visitor Parking South 1901 Veterans Memorial Drive Temple, Bell County, Texas	A-1
Checked By: JPJ	File No. 96155050	PH. (512) 442-1122 FAX. (512) 442-1181		
Approved By: JPJ	Date: April 22, 2015			



Property Boundary

Boring Locations

Boring not performed due to access constraints

Project Mngr: JPJ	Project No. 96155050	Terracon Consulting Engineers and Scientists	BORING LOCATION DIAGRAM	EXHIBIT
Drawn By: Austin CAD	Scale: AS SHOWN	5307 INDUSTRIAL OAKS BLVD. - #160 AUSTIN, TX 78735	VAMC Visitor Parking South	A-2
Checked By: JPJ	File No. 96155050	PH. (512) 442-1122 FAX. (512) 442-1181	1901 Veterans Memorial Drive	
Approved By: JPJ	Date: April 22, 2015		Temple, Bell County, Texas	

Field Exploration Description

Subsurface conditions were evaluated by performing 4 borings (B-1 through B-3 and B-5) to depths of about 10 feet in the proposed roadway areas. Boring B-4 was not performed due to access constraints and lack of utility layout/markings to perform reasonable offsets.

The boring locations were staked on site by a Terracon representative using the site plan/drawing provided to us and, using GPS coordinates from the Google Earth® mapping system. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with truck-mounted rotary drilling equipment at the approximate locations shown on Exhibit A-2 of Appendix A. Boring depths were measured from the existing ground surface at the time of our field activities.

Soil samples were recovered by means of thin-walled, open-tube samplers (Shelby tubes) or by the Standard Penetration Test (SPT). A pocket penetrometer test was performed on each sample of cohesive soil in the field to serve as a general measure of consistency. The SPT consists of split-barrel sampling procedures, in which a standard 2-inch (outside diameter) split-barrel sampling spoon is driven into the ground with a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. These values, also referred to as SPT N-values, are an indication of soil strength and are provided on the boring logs at the depths of occurrence. The samples were sealed and transported to the laboratory for testing and classification.

An automatic SPT hammer was used to advance the split-barrel sampler in the boring performed on this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT values and soil properties are based on the lower efficiency cathead and rope method. The higher efficiency of automatic hammer affects the standard penetration resistance blow count (N) value by increasing the penetration per hammer blow over what would obtained using the cathead and rope method. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Samples were removed from the samplers in the field, visually classified, and appropriately sealed in sample containers to preserve the in-situ moisture contents. Samples were then placed in core boxes for transportation to our laboratory in Austin, Texas.

The boring logs, which include the subsurface descriptions, types of sampling used, and additional field data for this study, are presented on Exhibits A-4 through A-7 of Appendix A. Criteria defining terms, abbreviations and descriptions used on the boring logs are presented in Appendix C.

BORING LOG NO. B-1

PROJECT: VAMC Visitor Parking South

CLIENT: H2B, Inc.
Houston, TX 77008

SITE: 1901 Veterans Memorial Drive
Temple, Texas

LOCATION See Exhibit A-2

Latitude: 31.074741° Longitude: -97.347028°

GRAPHIC LOG	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	2.0	**FILL - FAT CLAY (CH)**, trace sand, brown, stiff to very stiff				2.5 tsf (HP)				22		52-21-31	90
	5.5	**FAT CLAY (CH)**, dark brown, medium stiff to very stiff				1.0 tsf (HP)				38		81-22-59	94
			5			4.5+ tsf (HP)				23			
	7.0	**CLAYEY SAND (SC)**, tan, dense to very dense				14-44-50/2"							
	10.0	**MARL/WEATHERED LIMESTONE**, tan to light brown clay layer between 8 and 9 ft. depth interval				27-50/2"				22		52-21-31	93
		Boring Terminated at 10 Feet	10										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered 0 to 10 feet

Abandonment Method:
Backfilled with Auger Cuttings and/or Bentonite

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS
No free water observed

Terracon
5307 Industrial Oaks Blvd., Suite 160
Austin, Texas

Boring Started: 3/24/2015	Boring Completed: 3/24/2015
Drill Rig: CME 55	Driller: Austin Geo-Logic
Project No.: 96155050	Exhibit: A-4

BORING LOG NO. B-2

PROJECT: VAMC Visitor Parking South

CLIENT: H2B, Inc.
Houston, TX 77008

SITE: 1901 Veterans Memorial Drive
Temple, Texas

LOCATION See Exhibit A-2

Latitude: 31.075007° Longitude: -97.347132°

GRAPHIC LOG	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.4	**PAVEMENT:** Approx. 1" asphaltic concrete over 4" granular base material											
	2.0	**FILL - FAT CLAY (CH)**, trace sand, dark brown, very stiff				5-8-8 N=16				22		73-22-51	87
	3.0	**LEAN CLAY (CL)**, with sand, tan, very stiff to hard				7-25-50/2"				9		33-17-16	81
		WEATHERED LIMESTONE, tan to light brown, with clay lenses				32-50/2"				9			
			5			50/4"							
	10.0					50/5"							
		Boring Terminated at 10 Feet	10										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered 0 to 10 feet

Abandonment Method:
Backfilled with Auger Cuttings and/or Bentonite
Surface Capped with Asphalt

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
5307 Industrial Oaks Blvd., Suite 160
Austin, Texas

Boring Started: 3/24/2015	Boring Completed: 3/24/2015
Drill Rig: CME 55	Driller: Austin Geo-Logic
Project No.: 96155050	Exhibit: A-5

BORING LOG NO. B-3

PROJECT: VAMC Visitor Parking South

CLIENT: H2B, Inc.
Houston, TX 77008

SITE: 1901 Veterans Memorial Drive
Temple, Texas

LOCATION See Exhibit A-2

Latitude: 31.075224° Longitude: -97.346878°

DEPTH	Material Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	FILL - FAT CLAY (CH), with sand, dark brown, stiff				3-7-8 N=15				24		63-21-42	83
2.0	**FAT CLAY (CH)**, dark brown, stiff				3-6-9 N=15				20		72-20-52	
4.0	**WEATHERED LIMESTONE**, tan to light brown				50/6"				10			
		5										
					50/4"				11			
					50/5"							
10.0	***Boring Terminated at 10 Feet***	10										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered 0 to 10 feet

Abandonment Method:
Backfilled with Auger Cuttings and/or Bentonite

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
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Austin, Texas

Boring Started: 3/24/2015	Boring Completed: 3/24/2015
Drill Rig: CME 55	Driller: Austin Geo-Logic
Project No.: 96155050	Exhibit: A-6

BORING LOG NO. B-5

PROJECT: VAMC Visitor Parking South

CLIENT: H2B, Inc.
Houston, TX 77008

SITE: 1901 Veterans Memorial Drive
Temple, Texas

LOCATION See Exhibit A-2

Latitude: 31.076025° Longitude: -97.346506°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.8	**FILL - , Approx. 9" granular base material**											
2.0	**FILL - POORLY GRADED SAND WITH CLAY (SP)**, trace gravel, brown, medium dense			X	14-12-9 N=21				8			
4.0	**FILL - LEAN CLAY (CL)**, with sand, brown to gray tan brown, stiff			X	2-4-6 N=10				18		40-16-24	
7.0	**LEAN CLAY (CL)**, trace sand, tan to light brown, hard	5		X	12-24-32 N=56				15		47-17-30	85
				X	25-50/5"				12			
10.0	**MARL/WEATHERED LIMESTONE**, light gray to grayish brown			X	35-50/5"				12			
	Boring Terminated at 10 Feet	10										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered 0 to 10 feet

Abandonment Method:
Backfilled with Auger Cuttings and/or Bentonite

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
5307 Industrial Oaks Blvd., Suite 160
Austin, Texas

Boring Started: 3/24/2015	Boring Completed: 3/24/2015
Drill Rig: CME 55	Driller: Austin Geo-Logic
Project No.: 96155050	Exhibit: A-7

APPENDIX B

LABORATORY TESTING

Laboratory Testing

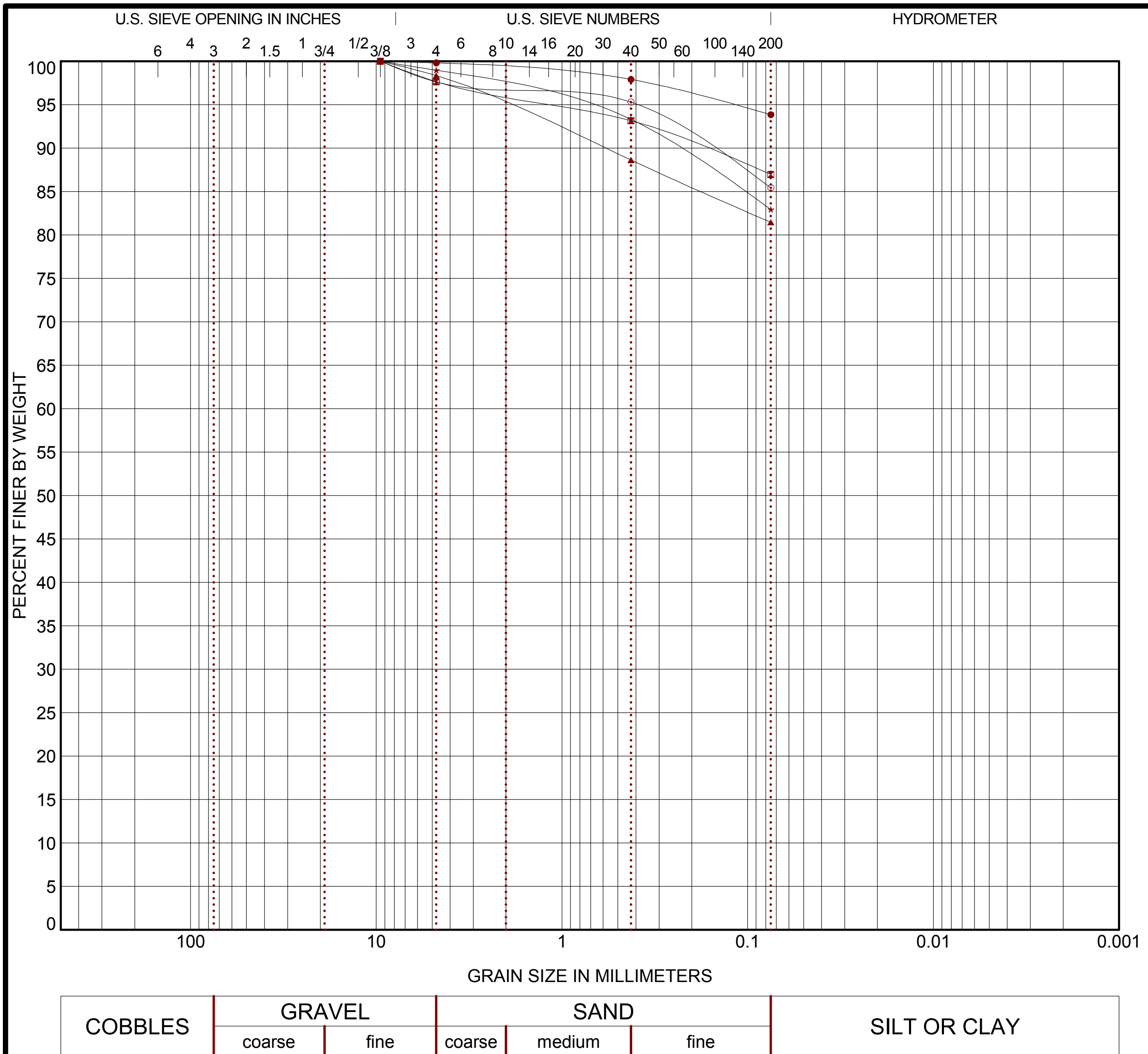
Samples obtained during the field program were visually classified in the laboratory by a geotechnical engineer. A testing program was conducted on selected samples, as directed by the geotechnical engineer, to aid in classification and evaluation of engineering properties required for analyses.

Results of the laboratory tests are presented on the boring logs, located on Exhibits A-4 through A-7 of Appendix A, Exhibit B-2 of this Appendix and/or are discussed in **Section 3.0 – Subsurface Conditions** of the report. Laboratory test results were used to classify the soils encountered as generally outlined by the Unified Soil Classification System.

Samples not tested in the laboratory will be stored for a period of 30 days subsequent to submittal of this report and will be discarded after this period, unless we are notified otherwise.

GRAIN SIZE DISTRIBUTION

ASTM D422



Boring ID		Depth	USCS Classification	LL	PL	PI	Cc	Cu
●	B-1	2 - 4	FAT CLAY(CH)	81	22	59		
⧗	B-2	0 - 1.5	FAT CLAY(CH)	73	22	51		
▲	B-2	2 - 3.167	LEAN CLAY with SAND(CL)	33	17	16		
★	B-3	0 - 1.5	FAT CLAY with SAND(CH)	63	21	42		
⊙	B-5	4 - 5.5	LEAN CLAY(CL)	47	17	30		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
●	B-1	2 - 4	9.5				0.2	6.0	93.9	
⧗	B-2	0 - 1.5	9.5				2.4	10.7	87.0	
▲	B-2	2 - 3.167	9.5				1.7	16.9	81.5	
★	B-3	0 - 1.5	9.5				1.0	16.0	82.9	
⊙	B-5	4 - 5.5	9.5				2.4	12.2	85.4	

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PROJECT NUMBER: 96155050

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Houston, TX 77008

EXHIBIT: B-2

APPENDIX C

SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING		WATER LEVEL		FIELD TESTS	
	Shelby Tube Split Spoon		Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.		N — Standard Penetration Test Resistance (Blows/Ft.) (TC) — TxDOT Cone Penetration Test (blows per Foot) (HP) — Hand Penetrometer (T) — Torvane (DCP) — Dynamic Cone Penetrometer (PID) — Photo-Ionization Detector (OVA) — Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

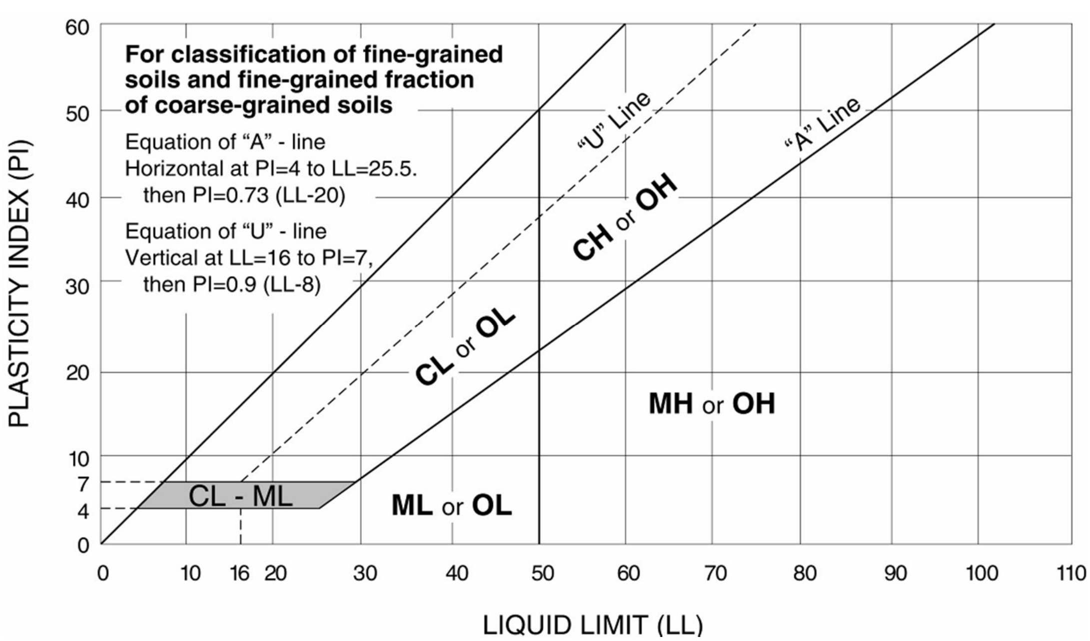
PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification: Group Symbol	Soil Classification: Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]	GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]	SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G,H,I]
			Fines classify as CL or CH	SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]	CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [K,L,M,N]
					Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K,L,M]
			PI plots below "A" line	MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [K,L,M,P]
					Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve
[B] If field sample contained cobbles or boulders, or both, add "with cobbles and/or boulders" (or both) to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay
[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] $PI \geq 4$ and plots on or above "A" line.
[O] $PI < 4$ or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



Terracon

Exhibit C-2